STATE OF IDAHO, DEPARTMENT OF AGRICULTURE
DIVISION OF AGRICULTURAL RESOURCES

IN RE SMOKE MANAGEMENT AND	)	**DETERMINATION REGARDING**
CROP RESIDUE DISPOSAL ACT	)	**ECONOMICALLY VIABLE**
	)	**ALTERNATIVES TO THERMAL**
	)	**DISPOSAL OF CROP RESIDUE**
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This document is in regards to the *Smoke Management and Crop Residue Disposal Act* (Smoke Management Act) codified at Idaho Code § 22-4801 *et seq*. The Smoke Management Act requires that I make a determination that no economically viable alternatives to burning are available to Idaho producers. In 2003, I found that no economically viable alternatives to field burning were available for the purpose of disposing of crop residue, developing physiological conditions conducive to increased crop yields, or controlling diseases, insects, pests or weeds. Because scientific research is on-going in the area of crop residue disposal, I have decided to re-evaluate the determination I issued on July 22, 2003, certifying that no economically viable alternatives to field burning are available to Idaho producers. This determination supersedes my previous determination issued in 2003.

For the purpose of this determination, I construe the term "economically viable alternatives" to mean an alternative to thermal residue disposal that (1) achieves agricultural objectives comparable to thermal disposal for the factors listed in § 22-4803(1)(a)-(c) and (2) allows growers to experience a financial rate of return over the short- and long-term consistent with the rate of return that would occur if thermal residue disposal were utilized. I am required by the Smoke Management Act, for purposes of determining whether economically viable alternatives to field burning exist, to limit my determination to those alternatives that provide for the disposal of crop residue, create physiological conditions that will increase crop yields, or will control diseases, insects, pests or weed infestations. Specifically, the Smoke Management Act provides in Idaho Code § 22-4803(1):

> The open burning of crop residue grown in agricultural fields shall be an allowable form of open burning when the provisions of this chapter, and any rules promulgated pursuant thereto, and the environmental protection and health act, and any rules promulgated pursuant thereto, are met, and when no other economically viable alternatives to burning are available, as determined by the director, for the purpose of:
>
> (a) Disposing of crop residue;
> (b) Developing physiological conditions conducive to increased crop yields; or
> (c) Controlling diseases, insects, pests or weed infestations.

I have instructed my staff to compile all available information on crop residue disposal, including emails, letters, memoranda and other documents received from the public along with scientific research related to crop residue disposal. I have reviewed the documents compiled by my staff and those documents submitted by the general public. These documents and the documents comprising the Administrative Record supporting the determination issued in 2003 are the basis for my determination and I incorporate them herein by reference (hereinafter "Administrative Record" or "AR"). An index comprising the list of documents that I have reviewed is attached to this memo. The following represents my determination as directed by the Smoke Management Act.

NON-THERMAL METHODS OF CROP RESIDUE DISPOSAL

If thermal disposal of crop residue is not utilized as a method of managing post-harvest crop residue, a mechanical technique must be employed to remove crop residue from the field. Post-harvest crop residue must be managed in order to create physiological conditions on the field to maintain seed yields, manage disease, weeds, and pests, and prepare the field for subsequent harvest.

A number of mechanical residue removal techniques are currently being studied as possible alternatives to thermal disposal of crop residue. Common techniques include raking, flailing and baling the residue or vacuum sweeping the residue off from the field. *See* Glen A. Murray Paper; AR B-191. The mechanical raking technique may employ a needle-nose rake with stiff tines to scratch the residue and thatch to remove debris from around the crown of the plant. *See* Effects of Various Types of Post-Harvest Residue Management on Kentucky Bluegrass Seed Yield in Central Oregon, On-Farm Results from 1991-1996; AR F36-983. The residue is windrowed and then baled and removed from the field. *See id.* Alternatively, a close-clipping and vacuuming machine may remove the residue and leave the stubble at approximately one (1) inch in height. *See id*. Mechanical residue removal, regardless of the particular technique employed, must remove at least 90 percent of the residue or shorten the stubble height to less than two inches in order to produce similar results to thermal disposal of crop residue. *See* Potential Alternatives to Field Burning in the Grand Ronde Valley; AR E25-832.

NON-THERMAL DISPOSAL PRODUCTION/MARKETING COSTS

Capital investments are required to convert from a crop residue management system utilizing field burning to a mechanical crop residue management system. Capital costs vary depending upon the equipment utilized, which may include a needle-nose rake wheel and baler or a vacuum machine in addition to storage costs discussed, which are discussed below. The costs associated with financing these capital investments are estimated at 10 percent of the principle amount financed. *See* The Effect of the "No-Burn Ban" on the Economic Viability of Producing Bluegrass Seed in Select Areas of Washington State at 2; AR H9-1499.

Once residue has been harvested and baled it must be stored or transported to market. If the residue is stored, it must be protected from moisture in order to preserve it for later use. *See* Status Report on Alternative Uses For Grass Straw at 8; AR E1-633. Improperly stored residue will deteriorate to the point that it is only suitable for disposal or composting. *See id.*

Temporary storage costs incurred in utilizing tarps to cover the residue are estimated at $4.00 per ton per year assuming that the tarps will last for two years. *See id.* Permanent hay buildings are estimated at $7.00 to $10.00 per ton per year, or approximately $50.00 per ton for the initial capital cost. *See id.*

Transportation costs vary depending on the location where the residue must be transported from and the availability of trucks to haul the residue to the desired market. In addition, large hay bales are costly to transport due to the fact that they do not fit efficiently on hay trucks. *See id.* The fact that trucks cannot be fully loaded increases the transportation costs. *See id.* Transportation costs for producers in Spokane County, Washington to haul residue to a nearby feed facility are approximately $25.00 per ton. *See id.* Local transportation costs range from $10.00 to $20.00 per ton for a 100-150 mile round trip.

CROP RESIDUE USES AND SALE

Once the crop residue is mechanically removed from the field, a number of uses are available for crop residue that may off-set some of the additional costs associated with a mechanical residue management regime. Three broad categories of alternative uses for crop residue are identifiable from reviewing the Administrative Record. They are off-farm disposal, on-farm use and off-farm use. *See* Status Report on Alternative Uses for Grass Straw, Washington State Department of Ecology at 11; AR E1-636. Specific crop residue uses are identified within one of the three categories discussed separately below.

Off-Farm Disposal

Livestock Feed: Crop residue that is utilized for livestock feed has been estimated to bring returns to producers ranging from $0.00 to $40.00 per ton. *See* UI Bluegrass Seed Producers Earn Less Without Field Burning at 1; AR H7-1491. Drought conditions play an important role in determining the market value for baled crop residue used for livestock feed. *See id.* When drought conditions ease in Montana the market could quickly become saturated if Idaho producers enter the livestock feed market. *See id.* Accordingly, livestock feed markets are uncertain for Idaho producers.

Incineration or land fill: Crop residue may be disposed of in off-farm incinerators or land fills. No return is expected on this crop residue disposal technique and could increase farmer’s costs. It is anticipated that producers would utilize an incinerator or land fill only in those instances where no other market for the residue is available and storage is unavailable.

On-Farm Use

Soil Amendments: Composting of crop residue returns straw residue back to the soil, increasing the amount of organic matter. *See* Status Report on Alternative Uses for Grass Straw at 11; AR E1-636. Potential benefits of using the crop residue as a soil amendment includes erosion protection, reduced fertilizer requirements, retention of soil moisture, and improved seed germination and crop growth. *See id.* Composting costs range from $15.00 per acre to $30.00 per acre. *See id.* However, current composting technology does not address the unique problems faced by producers attempting to compost straw on a large farm-scale. *See* Composting Grass Seed Straw at 1; AR E2-666. A few options are available to producers, but "[a]dditional research is needed to assess long-term economic costs and agronomic benefits, and to further refine techniques and equipment." *Id.*

Alternate Year Harvest: An alternate year production theory is currently being studied on a North Idaho farm. *See* David Mosman Ranch Letter at 2; AR D1-455. This production theory consists of harvesting a seed crop every other year. *See id.* Chemicals are applied to the field to provide for residue suppression and weed control. *See id.* Specialized equipment will need to be purchased in order to manage crop residue in this manner. *See id.* This experiment is currently being conducted in long-term field experiments and does show some preliminary results that are promising. *See* University of Idaho Letter at 1; AR D4-533. Because these experiments are in progress, no conclusive data are available to determine the economic viability of this crop residue management alternative. *See id.*

Off-Farm Use

Pulp and Paper: No current pulp mill utilizes agricultural residues for the purpose of producing pulp and paper products. *See* Paper Manufacturing Using Agricultural Residues from Pacific Northwest Farmlands at 6; AR E23-782. It is possible to produce a relatively cost effective pulp for the corrugated medium sector utilizing crop residue. *See id.* However, current data are preliminary, and the research was performed on a small scale. *See id.*

Power Generation: Crop residue could potentially generate up to 400 to 425 megawatts of electricity annually. *See* Straw to Energy? It Might Be Worth a Try at 1; AR E28-841. However, significant barriers to entry in this market include the construction of new facilities and the cost of storing and transporting the straw. *See* Status Report on Alternative Uses for Grass Straw at 11; AR E1-636. Crop residue is not currently being utilized as a source of commercial power generation.

Bio-Fuels: Ethanol plants could potentially utilize crop residue as a raw material. *See id.* However, the current ethanol manufacturing facilities under construction in Washington do not have plans to utilize crop residue as feedstock for ethanol manufacture. *See id.*

NON-THERMAL RESIDUE DISPOSAL AND CROP YIELDS

Under a post-harvest non-thermal crop residue disposal system, crop yields will be affected negatively. In Spokane County, Washington, a dry land Kentucky bluegrass producer utilizing a non-thermal residue disposal system may realize four years of production before the bluegrass stand must be re-established or rotated out of production. *See* The Effect of the "No-Burn Ban" on the Economic Viability of Producing Bluegrass Seed in Select Areas of Washington State at 8; AR H9-1505. However, if thermal residue disposal is utilized, that same Spokane County producer could expect a productive bluegrass stand life of at least seven years. *See id.* Thus, non-thermal residue disposal has the practical effect of decreasing crop yields by shortening the productive stand life of the bluegrass field; *i.e.*, the dry land farmer is required to re-establish the field more frequently to maintain a yield level comparable to what would be achieved employing thermal disposal methods.

Non-thermal crop residue disposal may also affect the pounds of clean seed harvested annually. In the first two years a crop is harvested, the yield is comparable to that of fields utilizing a thermal crop residue disposal system. *See id.* However, in the third year and fourth years of production, a Kentucky bluegrass stand may yield up to 45 to 60 percent less clean seed. *See* Assessment of Non-Thermal Bluegrass Seed Production at 13; AR D2-469. Yield comparisons between similarly situated Kentucky bluegrass stands in North Idaho and Eastern Washington show that fields not being burned produce approximately 173 pounds per acre less than fields that are burned over a three year period, with yields trending downward. *See id.* It may be possible for a post-harvest non-thermal crop residue disposal system to maintain yields that are comparable with those fields that burn crop residue, but fertilizer and chemical inputs must be increased. *See id.* at 14, AR D2-470. These higher yields nonetheless can be maintained only for two or three production years before the bluegrass stand must be re-established. *See id.*

NON-THERMAL RESIDUE DISPOSAL AND RATES OF RETURN

The cost of producing bluegrass seed utilizing a post-harvest mechanical crop residue disposal system depends primarily on three key factors: (1) the production life of an established bluegrass seed field; (2) the expected annual yields; and (3) the price that can be obtained for bluegrass residue. *See* The Effect of the "No-Burn Ban" on the Economic Viability of Producing Bluegrass Seed in Select Areas of Washington State at 18; AR H9-1515. As discussed above, the production life of an established bluegrass seed field and the expected annual yields from these bluegrass fields are affected negatively by restricting the use of post-harvest thermal crop residue management.

The third factor, price obtained for bluegrass residue, has been valued in a range from $0.00 per ton to $40.00 per ton. *See supra* at 3. Recently, baled bluegrass residue has been worth approximately $30.00 to $40.00 per ton. *See* Assessment of Non-Thermal Bluegrass Seed Production at 14; AR D2-470. This recent market price, however, appears to be inflated artificially due to drought conditions in Montana and may not be representative of long-term pricing. *See id.* at 15, 471.

A Washington State University Study issued in 2001 estimated the break-even price for Spokane County Kentucky bluegrass producers to be 58 cents per pound when thermal crop residue management was employed versus 84 cents per pound when non-thermal crop residue management practices were utilized. *See* Effect of the "No-Burn Ban" on the Economic Viability of Producing Bluegrass Seed in Select Areas of Washington State at 21; AR H9-1518. The study concluded that, "under current conditions in Spokane County, it is estimated that the cost of producing bluegrass seed under the 'no-burn ban' has increased the cost per pound of production by 25¢ or more"—an increase of approximately 43 percent—even where crop residue sold for $31 per ton. *Id.* An expert witness appearing on behalf of opponents to crop residue burning proffered as a mid-point estimate approximately $55.00 to $60.00 per acre in additional costs for North Idaho Kentucky bluegrass producers if non-thermal crop residue disposal is required. *See* Deposition of C. Richard Shumway, Ph.D. at 85; AR J-2003 AR Tab 18. A third study has estimated the increase in production costs accompanying use of non-thermal disposal to be $70 per acre. Concise Explanatory Statement, Agricultural Burning, Grass Seed Field Burning Alternative Certification Amendment at 16; AR J-2003 AR Tab 16. The administrative record thus indicates that, regardless of which study or testimony is reviewed, rates of return will be reduced significantly for dry land Kentucky bluegrass farmers in Idaho if they are prohibited from using thermal crop residue disposal methods.

It should be noted that comparisons drawn between Kentucky bluegrass producers in the ten northern Idaho counties specified in § 22-4803(3) and Washington State Kentucky bluegrass producers were limited to those farmers in Spokane County, Washington. The comparisons were limited to Spokane County producers because of the proximity of North Idaho producers with Spokane County producers and the environmental similarities, *i.e.*, similar length of growing seasons, steep farmland terrain, and annual rainfall. Most important is the fact that both North Idaho and Spokane County farmers grow crops under a dry land production system due to the lack of available water for irrigation. Dry land farming conditions also significantly limit the availability of alternative crops to these producers.

SUMMARY AND FINDINGS

A number of crop residue markets have been explored since the state of Washington significantly reduced thermal disposal of crop residue in 1996. *See* North Idaho Farmers Letter at 1; AR B-60. A task force convened by the state of Washington studied several alternative disposal techniques but failed to find one effective or feasible method for utilizing post-harvest crop residue. *See id.* Problems associated with finding a feasible crop residue disposal alternative are prohibitive capitalization costs, more crop residue is produced than can be consumed, unprofitable alternatives or alternatives requiring subsidization, variation in straw types and content, and limited markets for crop residue products. *See id.* New economic burdens placed upon producers under a mechanical crop residue management regime have been estimated at approximately $70.00 per acre. *See* Concise Explanatory Statement, Agricultural Burning, Grass Seed Field Burning Alternative Certification Amendment at 16; AR J-2003 AR Tab 16; *see also* Deposition of C. Richard Shumway, Ph.D. at 85; AR J-2003 AR Tab 18. In addition, these costs compound the decrease in profit realized from a reduced stand life and the possibility of a reduced yield under a mechanical crop residue management scenario. *See* Deposition of Arthur Schulteis at 5; AR J-2003 AR Tab 3. Even the most optimistic of economic off-sets associated with a mechanical crop residue management system, *i.e.*, $40.00 per ton return on baled straw utilized as livestock feed, are not sufficient to cover the likely costs of converting from field burning to a mechanical crop residue management system. Therefore, based on my review of the Administrative Record, I find that no economically viable alternatives for crop residue disposal are available for Idaho producers currently utilizing a thermal disposal protocol for crop residue. I further find with reference to the three purposes identified in § 22-4803(1):

(a) <u>Disposing of crop residue:</u> The Administrative Record indicates that alternative markets for baled bluegrass residue are speculative and equipment, storage, transportation, and additional inputs are cost prohibitive.

(b) <u>Developing physiological conditions conducive to increased crop yields:</u> The Administrative Record indicates that thermal production of Kentucky bluegrass is necessary to achieve adequate thinning of the bluegrass stand and to provide adequate light to the grass crowns and tillers.

The Administrative Record regarding mechanical removal of Kentucky bluegrass residue indicates that non-thermal bluegrass seed production systems will reduce the consecutive number of bluegrass seed crops from seven or more to approximately three crops. These data do not support the economic viability of a non-thermal disposal protocol requiring Idaho producers to harvest a substantial seed crop for approximately seven to ten years in order to recoup high input, stand establishment and continuing management costs.

(c) <u>Controlling diseases, insects, pests or weed infestations:</u> The Administrative Record indicates that Kentucky bluegrass stands utilizing a mechanical post-harvest crop residue management regime requires significantly higher input costs to control disease, insects, pests, and weeds. These input costs include increased fertilizer, pesticide, and herbicide applications as well as increased petroleum use.

Although these findings are issued based on research and comments reviewed dealing primarily with Kentucky bluegrass, I find no basis to conclude that economically viable alternatives to thermal crop residue disposal exist with respect to any other crop in Idaho where residue is removed through thermal disposal.

DATED this 28th day of June 2004.

PATRICK A. TAKASUGI
Director,
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Idaho State Department of Agriculture

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